

IN THE DRAWINGS

The attached sheet of drawings includes changes to Fig. 2. This sheet, which includes Fig. 2, replaces the original sheet including Fig. 2.

Attachment: Replacement Sheet

### REMARKS/ARGUMENTS

Favorable reconsideration of this application, in view of the present amendment and in light of the following discussion, is respectfully requested.

Claims 1-29 are pending. In the present amendment, Claims 1-4, 7, 9-20, 22, and 23 are currently amended and new Claims 24-29 are added. Support for the present amendment can be found in the original specification, for example, at page 4, lines 25-30, at page 8, lines 21-22, at page 11, lines 16-26, at page 14, lines 4-9, at page 19, line 29 to page 20, line 3, and in Figure 2. Thus, it is respectfully submitted that no new matter is added.

In the outstanding Office Action, Claim 22 was rejected under 35 U.S.C. § 101; Claims 11-13 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1 and 2 were rejected under 35 U.S.C. § 102(b) as anticipated by Alfano (U.S. Patent No. 4,479,499); Claims 3-5 and 9-23 were rejected under 35 U.S.C. § 103(a) as unpatentable over Alfano; Claims 6 and 7 were rejected under 35 U.S.C. § 103(a) as unpatentable over Alfano in view of Everett et al. (U.S. Publication No. 2002/0093655, hereinafter “Everett”); and Claim 8 was rejected under 35 U.S.C. § 103(a) as unpatentable over Alfano in view of Everett, and further in view of Karazivan et al. (U.S. Publication No. 2005/0181333, hereinafter “Karazivan”).

The specification and Figure 2 are hereby amended to correct some minor informalities and to be consistent with the remain figures and the original specification. It is respectfully submitted that no new matter is added.

Additionally, the claims of the present application are hereby amended, in part, to clarify that these claims should not be interpreted as means-plus-function or step-plus-function claims under 35 U.S.C. § 112, sixth paragraph.

In response to the rejection of Claim 22 under 35 U.S.C. § 101, Claim 22 is hereby amended to recite a computer readable medium as suggested in section 1 on page 2 of the

Office Action. It is respectfully submitted that no new matter is added. Thus, it is respectfully requested that the rejection of Claim 22 under 35 U.S.C. § 101 be withdrawn.

In response to the rejection of Claims 11-13 under 35 U.S.C. § 112, second paragraph, these claims are hereby amended as suggested in section 3 on page 3 of the Office Action. It is respectfully submitted that no new matter is added. Thus, it is respectfully requested that the rejection of Claims 11-13 under 35 U.S.C. § 112, second paragraph be withdrawn.

Turning now to the rejections of Claims 1-23 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a), Applicant respectfully requests reconsideration of these rejections and traverses these rejections, as discussed below.

Amended Claim 1 recites:

A dental caries detecting device, comprising:

an ultraviolet light source;

a fluorescence receiving portion that receives fluorescence from a tooth in response to ultraviolet irradiation from the ultraviolet light source;

a fluorescence data analysis portion that analyzes fluorescence data transmitted from the fluorescence receiving portion; and

a data display portion that displays data analyzed by the fluorescence data analysis portion,

said fluorescence data analysis portion analyzing the fluorescence data based on fluorescence intensities in at least two wavelength bands in a visible light range, a first wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 260 nm, and a second wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 170 nm.

Accordingly, in the dental caries detecting device recited in amended Claim 1, a lower limit of the wavelength width of the first and second wavelength bands is 10 nm. It is

respectfully submitted that the cited references do not disclose or suggest every feature recited in amended Claim 1.

Alfano describes a method and apparatus for detecting the presence of caries in teeth.<sup>1</sup> Specifically, Alfano describes that the apparatus includes a light source 11 that outputs light to pass through a narrow band filter 13 having a bandwidth of preferably less than about 10 nm.<sup>2</sup> Alfano further describes that the light emerging from the output legs 21, 23 passes through narrow band filters 25, 29 having a bandwidth of less than about 10 nm.<sup>3</sup>

However, it is respectfully submitted that Alfano does not disclose or suggest “said fluorescence data analysis portion analyzing the fluorescence data based on fluorescence intensities in at least two wavelength bands in a visible light range, a first wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 260 nm, and a second wavelength band of the at least two wavelength bands having a wavelength width from 10 nm to 170 nm,” as recited in amended Claim 1.

Instead, as discussed above, Alfano describes that the emitted light preferably has a bandwidth of less than about 10 nm and that the returning light passes through narrow band filters 25, 29 having a bandwidth of less than about 10 nm. Thus, Alfano describes analyzing a wave form of fluorescent spectrum measured via a band filter having a bandwidth of less than about 10 nm. Accordingly, the fluorescence intensity in the system described in Alfano is so weak that the spectrum of caries regions is normalized to have the peak of that spectrum identical to the peak of the spectrum for the non-carious regions thereby detecting the presence of caries based on the difference of the wave form of the respective spectra.<sup>4</sup> Additionally, as discussed above, Alfano describes using filters to make a wavelength width of a band filter on the light receiving side smaller.

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<sup>1</sup> See Alfano, at column 1, lines 6 and 7.

<sup>2</sup> See Alfano, at column 6, lines 1-8 and in Figure 8.

<sup>3</sup> See Alfano, at column 6, lines 17-25 and in Figure 8.

<sup>4</sup> See Alfano, at column 9, lines 26-35 and in Figures 11-13.

On the other hand, Claim 1 describes analyzing the intensity of fluorescence having a wider wavelength width of 10 nm or more. Thus, the data to be measured is different in Alfano which analyzes the wave form of fluorescent spectrum. In addition, it is possible for the dental caries detecting device recited in Claim 1 to evaluate an absolute intensity by measuring the intensity of fluorescence having a wide wavelength width, so that it is possible to judge the degree of process of dental caries such as whether they are primary or severe caries.

Therefore, it is respectfully submitted that Alfano does not disclose or suggest every feature recited in amended Claim 1. Thus, it is respectfully requested that the rejection of Claim 1 as anticipated by Alfano be withdrawn.

Claim 2 recites, in part, a dental caries detecting device, comprising “a fluorescence receiving portion that receives fluorescence from a single measuring area of a tooth in response to ultraviolet irradiation of at least two different light intensities from the ultraviolet light source.” Thus, in amended Claim 2, a *single* measuring area is measured using *two different* light intensities from the ultraviolet light source.

According to the analysis based on a plurality of the fluorescence intensities recited in amended Claim 2, a subtle change of carious conditions, for example, progress during caries treatment, can be measured. Since the depth of a tooth excited by an ultraviolet beam varies depending on the intensity, the degree of caries can be detected with high sensitivity.

Alfano describes utilizing probe signals to measure both a decayed and a non-decayed region.<sup>5</sup> The Office Action, on page 6, takes the position that Alfano describes “obtaining information for at least two different light intensities.”

However, it is respectfully submitted that Alfano does not disclose or suggest “a fluorescence receiving portion that receives fluorescence from a single measuring area of a

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<sup>5</sup> See Alfano, at column 7, lines 1-43.

tooth in response to ultraviolet irradiation of at least two different light intensities from the ultraviolet light source,” as recited in amended Claim 1.

Instead, as discussed above, Alfano describes that photodetectors *receive* different signals from a decayed and a non-decayed region that originated from a light source of a *single intensity*. Accordingly, the two different light signals discussed in Alfano are the light received back from two different areas of the tooth, and not two different light intensities emitted to the tooth. Thus, Alfano does not describe that a single area is measured using two different light intensities from the ultraviolet light source.

Therefore, it is respectfully submitted that Alfano does not disclose or suggest every feature recited in amended Claim 2. Thus, it is respectfully requested that the rejections of Claim 2, and all claims dependent thereon, as anticipated by or unpatentable over Alfano be withdrawn.

Independent Claims 9, 12, 14, and 23, while directed to alternative embodiments, each recites that the minimum wavelength widths of the wavelength bands is 10 nm. Accordingly, in view of the above discussion of Alfano with respect to Claim 1, it is respectfully submitted that independent Claims 9, 12, 14, and 23 patentably define over Alfano. Thus, it is respectfully requested that the rejection of Claims 9, 12, 14, and 23, and all claims dependent thereon, as unpatentable over Alfano be withdrawn.

Claim 10 is dependent on Claim 9, and thus is believed to be patentable for at least the reasons discussed above with respect to Claim 9. Further, Claim 10 recites, in part, “comparing a value of said dental caries degree  $CD_1$  and a lower threshold  $E_1$ , wherein the lower threshold  $E_1$  is calculated based on predetermined fluorescence intensities of a plurality of healthy teeth when measuring conditions of the ultraviolet irradiation device and the fluorescence receiving device are determined.” Accordingly, in amended Claim 10, the

lower threshold  $E_1$  is determined based on stored measurements from healthy teeth taken under the same measurement conditions of the current measurement.

As discussed above, Alfano describes measuring a decay and a non-decay region and comparing them. Thus, in Alfano, the measurement conditions may change between the decay and non-decay regions. Therefore, it is respectfully submitted that Claim 10, and Claim 11 which depends thereon, further patentably define over Alfano.

Turning now to the rejections of dependent Claims 6-8, it respectfully submitted that neither of the secondary references (Everett and Karazivan) cures the deficiencies noted in the above discussion of Alfano with respect to Claim 2.

Everett measures the intensity of backscattered light based on an optical coherence tomography (OCT) system.<sup>6</sup> Specifically, Everett measures the backscattered intensity from optical delay between a reference beam that is reflected from a mirror 48 and a beam that is reflected from a sample by direct irradiation.<sup>7</sup> That is, the reflected beam is measured, and mainly a surface condition (configuration) is measured in Everett. Accordingly, the system described in Everett is different from a system which measures fluorescence light.

Additionally, Everett describes carrying out judgment based on the surface condition obtained from the results of measurements. Thus, the target to be measured and the kinds of obtainable data are different in Everett from a system which carries out judgment based on the intensity of excitation light (light emitted from a tooth by being absorbed and excited) by irradiation of an ultraviolet beam.

Karazivan also measures the intensity of a reflected beam, and does not measure the fluorescent light.<sup>8</sup>

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<sup>6</sup> See Everett, at paragraph [0029].

<sup>7</sup> See Everett, at paragraph [0036].

<sup>8</sup> See Karazivan, at paragraph [0014].

Therefore, for at least the reasons discussed above, it is respectfully submitted that Claims 6-8 also patentably define over all of the cited references. Thus, it is respectfully requested that the rejections of Claims 6-8 be withdrawn.

New Claims 24-29 are hereby added. Support for new Claims 24-29 can be found in the original specification, for example, at page 19, line 29 to page 20, line 3. Thus, it is respectfully submitted that no new matter is added.

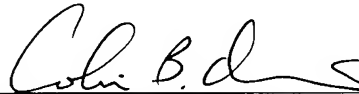
Additionally, it is noted that new Claims 24-29 depend on independent Claims 1, 2, 9, 14, and 23. Therefore, it is respectfully submitted that Claims 24-29 are patentable for at least the reasons discussed above with respect to Claims 1, 2, 9, 14, and 23.

Further, Claims 24-29, recite using a UV cut filter to block light of less than 400 nm. Thus, the UV cut filter enables to cut out the reflected light. Applicant respectfully submits that Alfano does not teach the cut of the reflected light specifically. Additionally, the secondary references describe measuring the reflected light. Thus, it is respectfully submitted that Claims 24-29 further patentably define over all of the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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